NORTH CAROLINA
Department of Transportation









Fall Protection

Introduction

- Falls are one of the most common causes of workplace injuries and deaths.
- The Bureau of Labor Statistics indicated slips, trips, and falls accounted for 229,240 nonfatal injuries in 2016.
  - 849 Fall Fatalities in 2016
  - 800 Fall Fatalities in 2015
  - 818 Fall Fatalities in 2014
  - 479 Fatal Falls in General Industry 2016
  - 370 Fatal Falls in Construction 2016
- Falls to a lower level accounted for 81% of all fatal falls.

Introduction

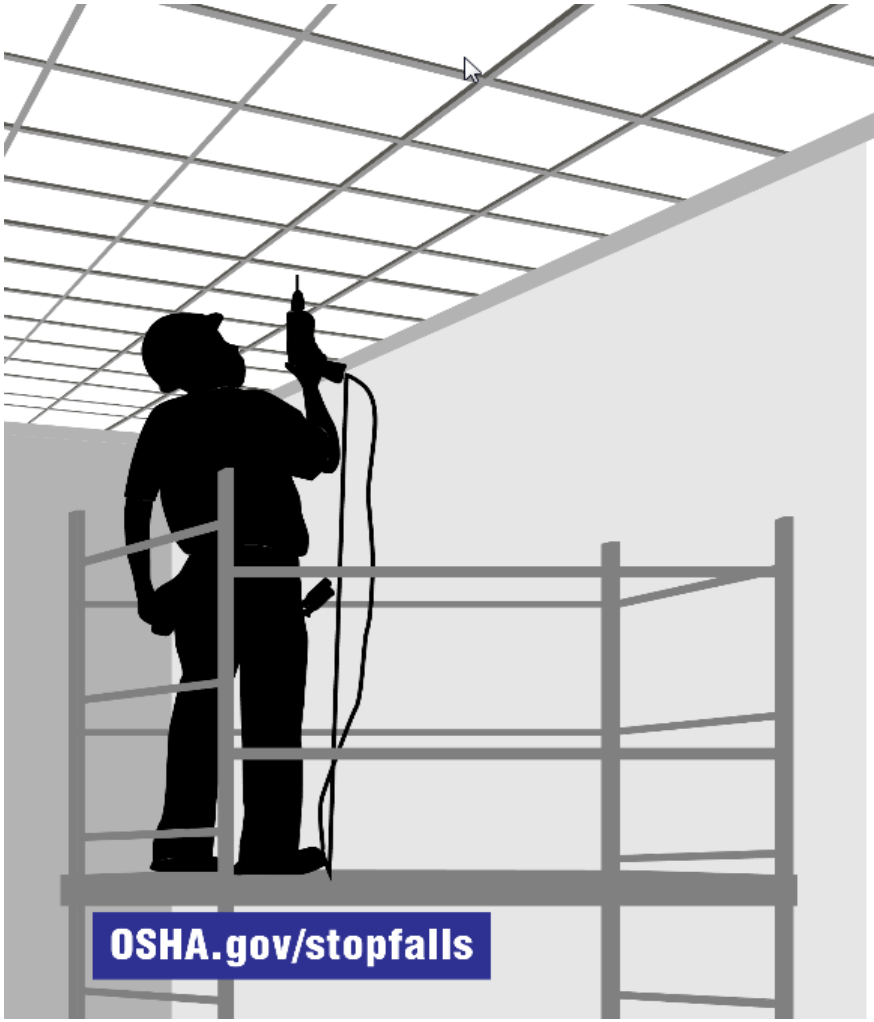
- OSHA requires the use of fall protection when working:
  - General Industry is **4** feet or more above a lower level.
  - Construction is **6** feet or more above a lower level.
  - Working above hazards.

FALLS account for 37% of deaths in construction

BLS data 2015

Construction
workers suffered
350
FATAL FALLS
in 1 year

BLS data 2015



Over **1 in 3**
FATAL FALLS
in construction
happen from
15 ft or less

BLS data 2015

Nearly

1 in 4

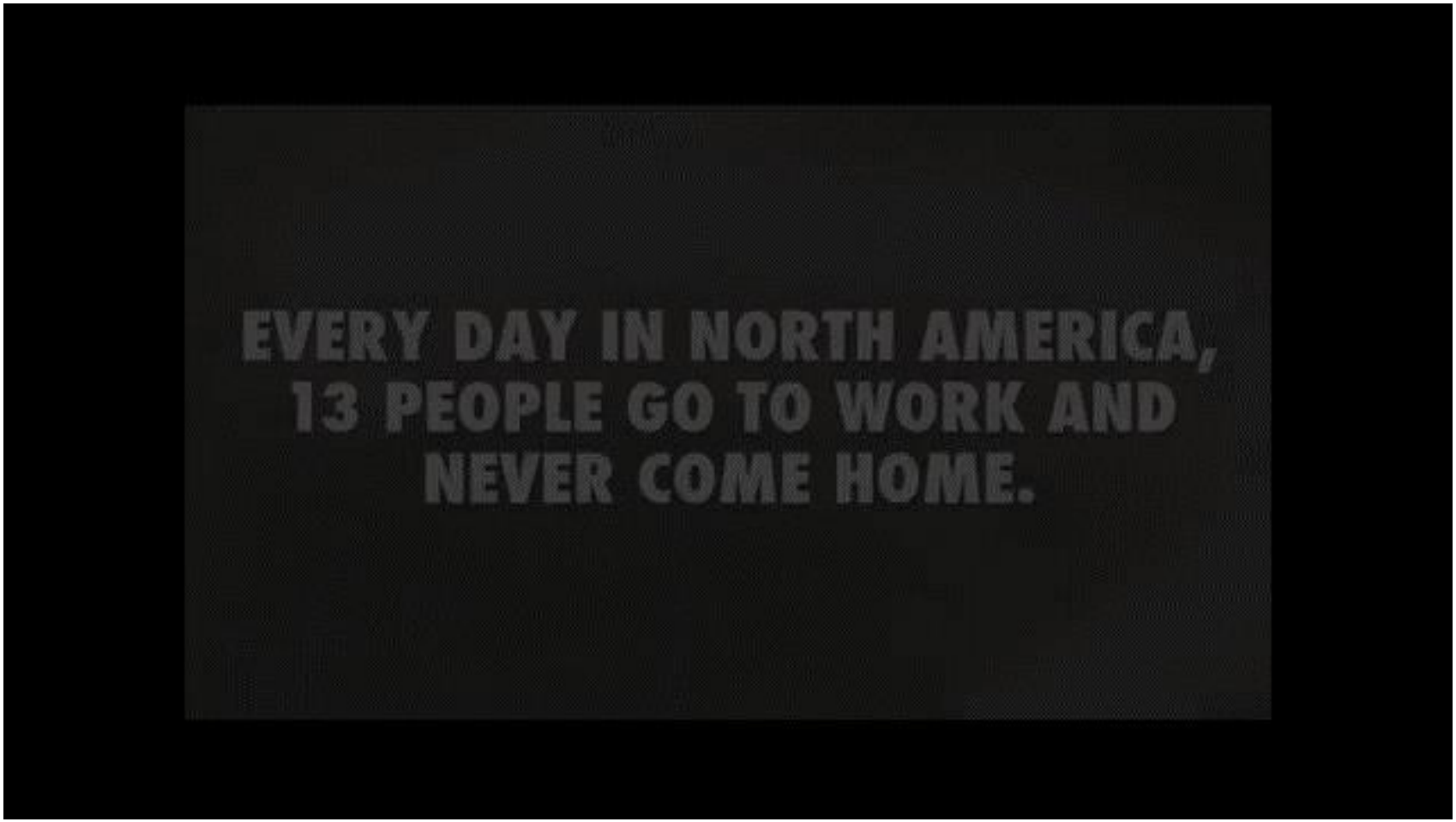
FATAL FALLS

in construction involve

LADDERS

BLS data 2015

Video


EVERY DAY IN NORTH AMERICA,
13 PEOPLE GO TO WORK AND
NEVER COME HOME.

Fatal Falls on NCDOT Projects

- Manns Harbor – April 2010
  - Sub contractor fell into water
- New Bern – June 2016
  - Sub contractor fell.
  - Rescued using crane.
- Hickory – August 2016
  - Sub contractor fell from bridge into water.
- Asheboro – March 2017
  - Sub contractor fell from bridge.

Fall Protection Saves Lives

Objectives

- At the completion of this course, the participants will be able to discuss and demonstrate the following topics:
  - Fall hazard recognition and assessment
  - Hierarchy of Controls
  - Selection, application, and use of fall protection systems

Training

- The training will be designed and conducted by a qualified person, and at minimum will cover:
  - How to recognize the fall hazards in your work area.
  - How to properly minimize or eliminate those hazards.
  - How to correctly install, set-up, inspect, operate, maintain, disassemble, and store any fall protection and equipment you use.
- Depending on your location, your training may also include requirements unique to your work area.

Fall Protection Standards

- ANSI Z359.2-2017 – Minimum Requirements for a Comprehensive Fall Protection Program
- Construction - OSHA 1926
  - work for construction, alteration, and/or repair, including painting and decorating
- General Industry – OSHA 1910
- Manufacturers Recommendations
  - Fixed Ladder System
  - Aerial lift, Hydra Platform, etc.

Employer Requirements

- The responsibility isn't all on your employer to protect you from fall hazards.
- You need to do your part by being aware of your work environment and equipment, and reporting any concerns or issues to your supervisor.

NCD0T Employee

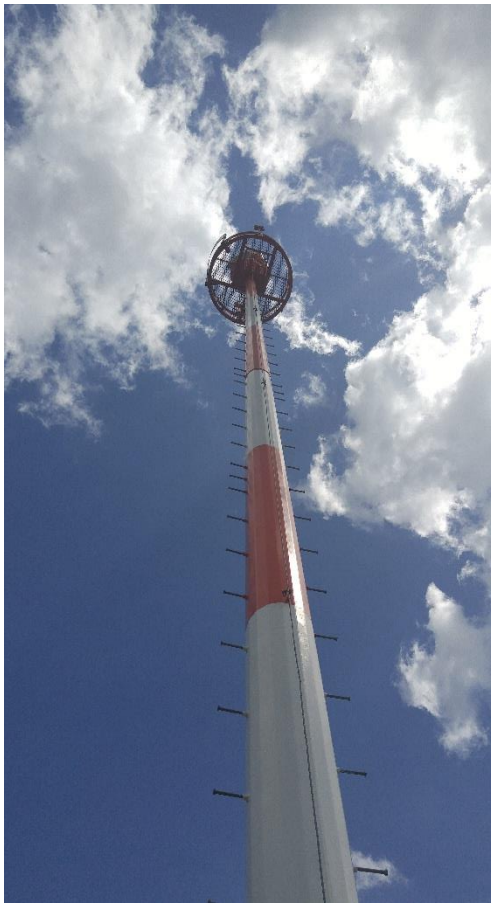
The GREAT work that the NCDOT performs!

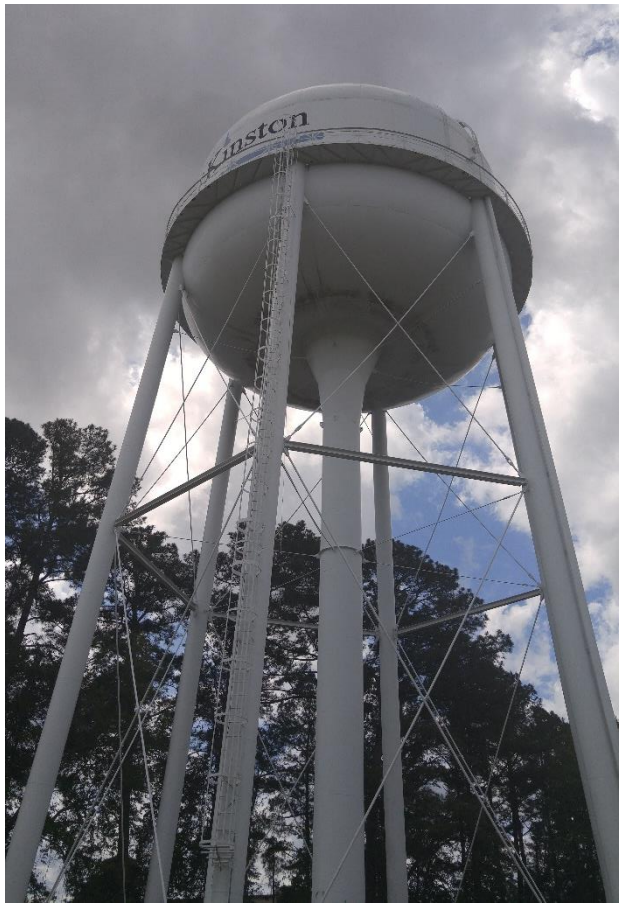
Bridge to be repaired

Tank Sounding

Truck Washing Station

Accessing Heights

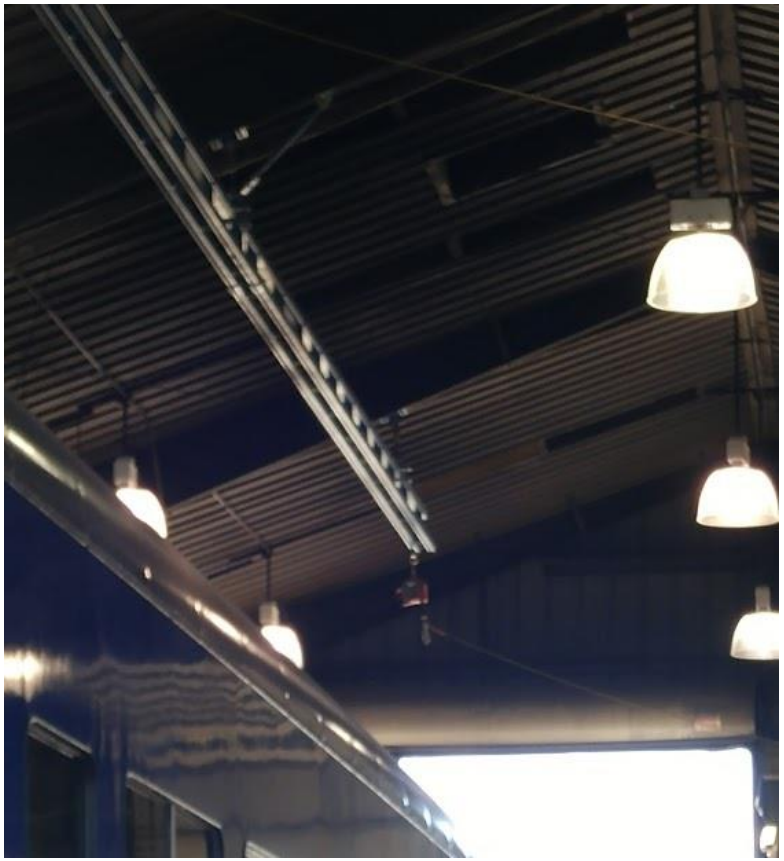




Railroad Trestle Work

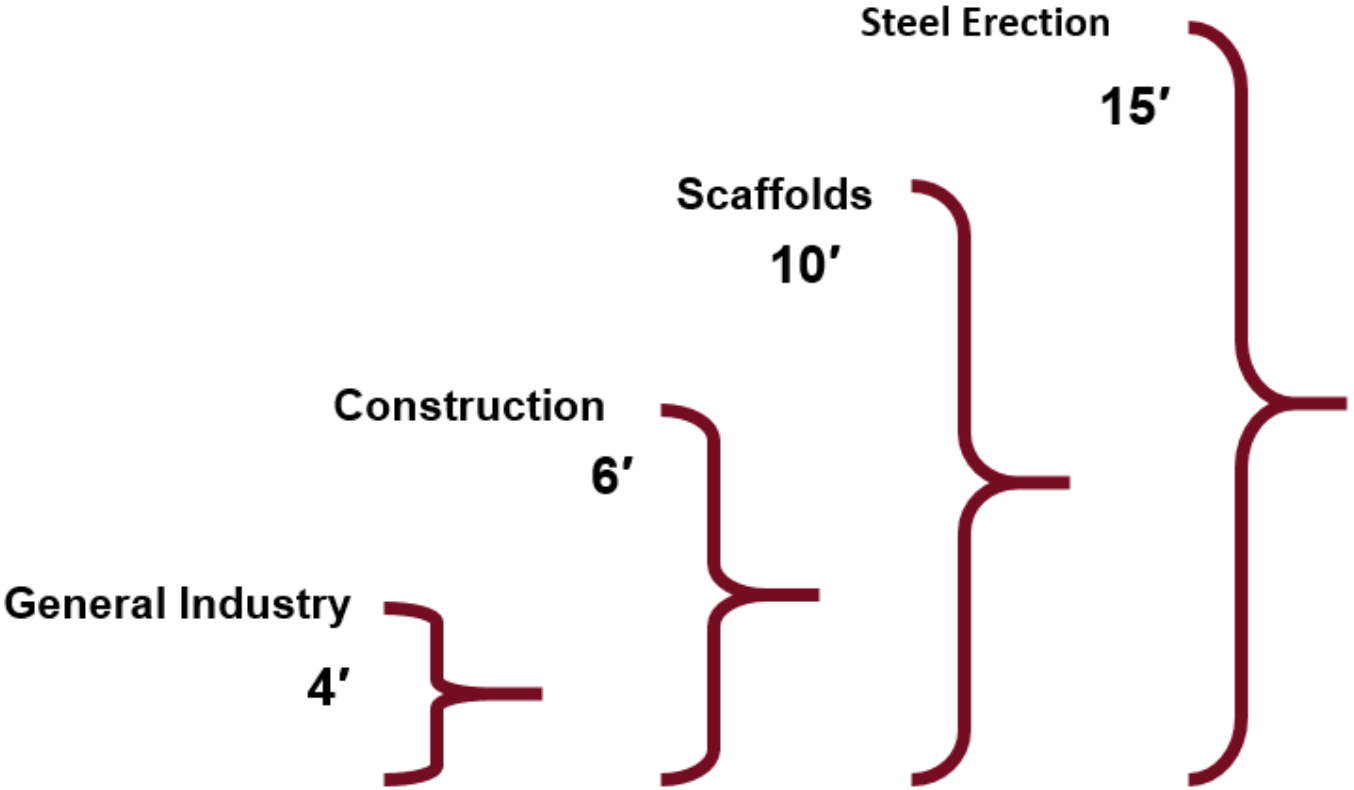
Bridge Work

Rail



Potential Hazards

When Is Fall Protection Required?



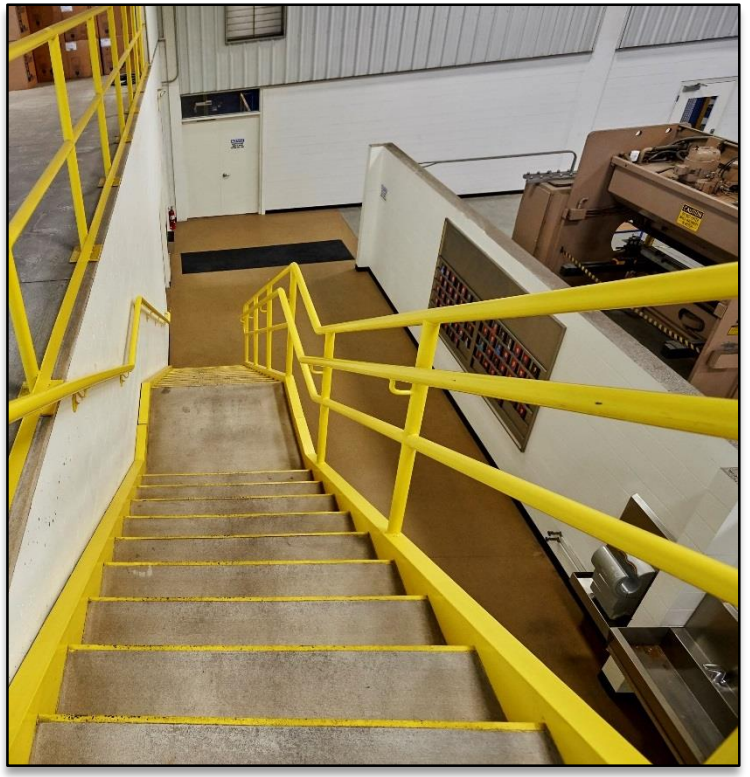
If workers are working over dangerous materials, pits, rebar, machinery, they must wear fall protection at all heights.

Potential Hazards

In order to reduce the risk of falls, it's important you are aware and recognize situations that can pose potential fall hazards.

There are three main types of hazards:

1. Unsafe environment
2. Unsafe equipment
3. Unsafe behavior



Unsafe Environment

Many times it's the environment that creates the fall hazard.

Example

If there's a large gap between a loading dock and trailer, and the dockboard you're using does not have appropriate guardrails, there's a chance you could fall off the edge to the surface below.

Unsafe Equipment

Sometimes, the equipment itself creates a hazard.

Example

If you are working on a mezzanine and discover a broken guardrail, the equipment could fail at providing you with the protection you need if you should fall.

Unsafe Behavior

Unsafe behavior also poses a potential hazard.

Example

If you do not tighten the leg straps of your harness appropriately and you fall, you could suffer serious injuries.

Example

Standing on top of boards placed across the Hydra Platform rail to get additional height with no fall protection.

Video – Unsafe Behavior

Quiz

- When is Fall Protection required for General Industry work?
  - Working 4 feet above another surface
  - Working above other hazards below
- What are examples of General Industry work?
  - Changing light bulbs
  - Hoist areas
  - Accessing a roof, bridge or water tower
  - Aerial lift work

Quiz

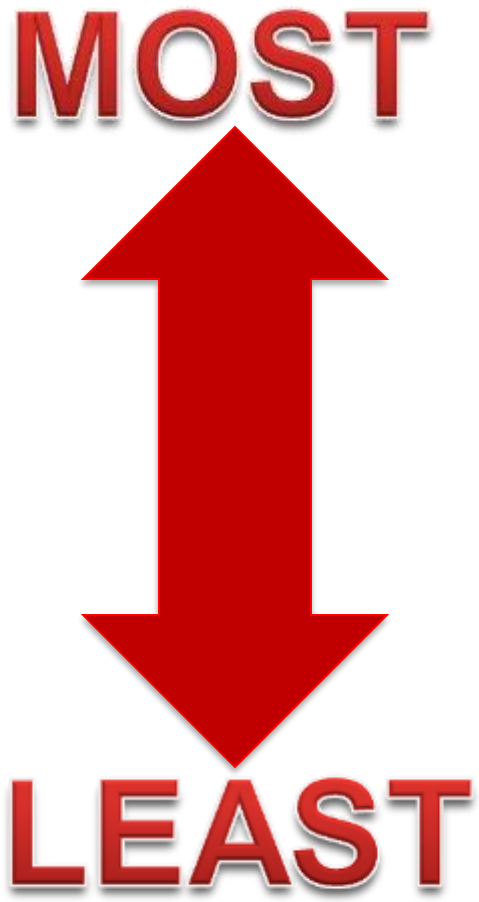
- When is Fall Protection required for Construction work?
  - Working 6 feet above another surface
  - Working above other hazards below
- What are examples of Construction work requiring fall protection?
  - Bridge repairs, construction or painting
  - Aerial lifts, Snooper, Snooker

Video

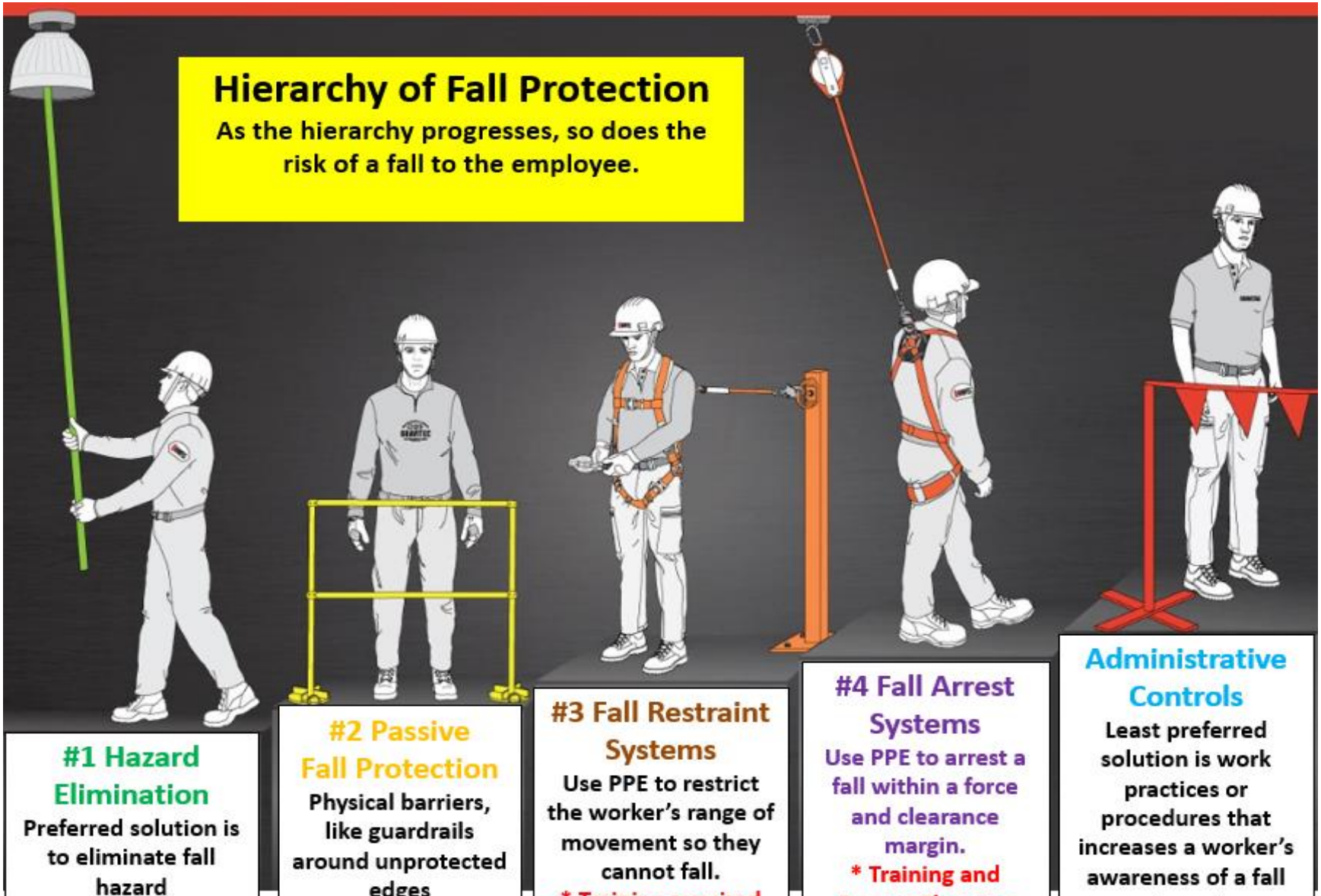

THE FACTS OF FALL PROTECTION
IDENTIFYING FALL HAZARDS AND DECIDING HOW TO PROTECT WORKERS

Types of Fall Protection

Fall Protection in Order of Effectiveness



- Elimination
- Engineering/ Prevention
- Fall Arrest
- Warning Lines
- Safety – Monitoring/ Administration


Hierarchy of Fall Protection
As the hierarchy progresses, so does the risk of a fall to the employee.
#1 Hazard Elimination
Preferred solution is to eliminate fall hazard
#2 Passive Fall Protection
Physical barriers, like guardrails around unprotected edges
#3 Fall Restraint Systems
Use PPE to restrict the worker's range of movement so they cannot fall.
* Training required
#4 Fall Arrest Systems
Use PPE to arrest a fall within a force and clearance margin.
* Training and Rescue Planning required
Administrative Controls
Least preferred solution is work practices or procedures that increases a worker's awareness of a fall hazard

Video


HIERARCHY OF FALL PROTECTION
AS DEFINED BY THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
AND THE AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE)

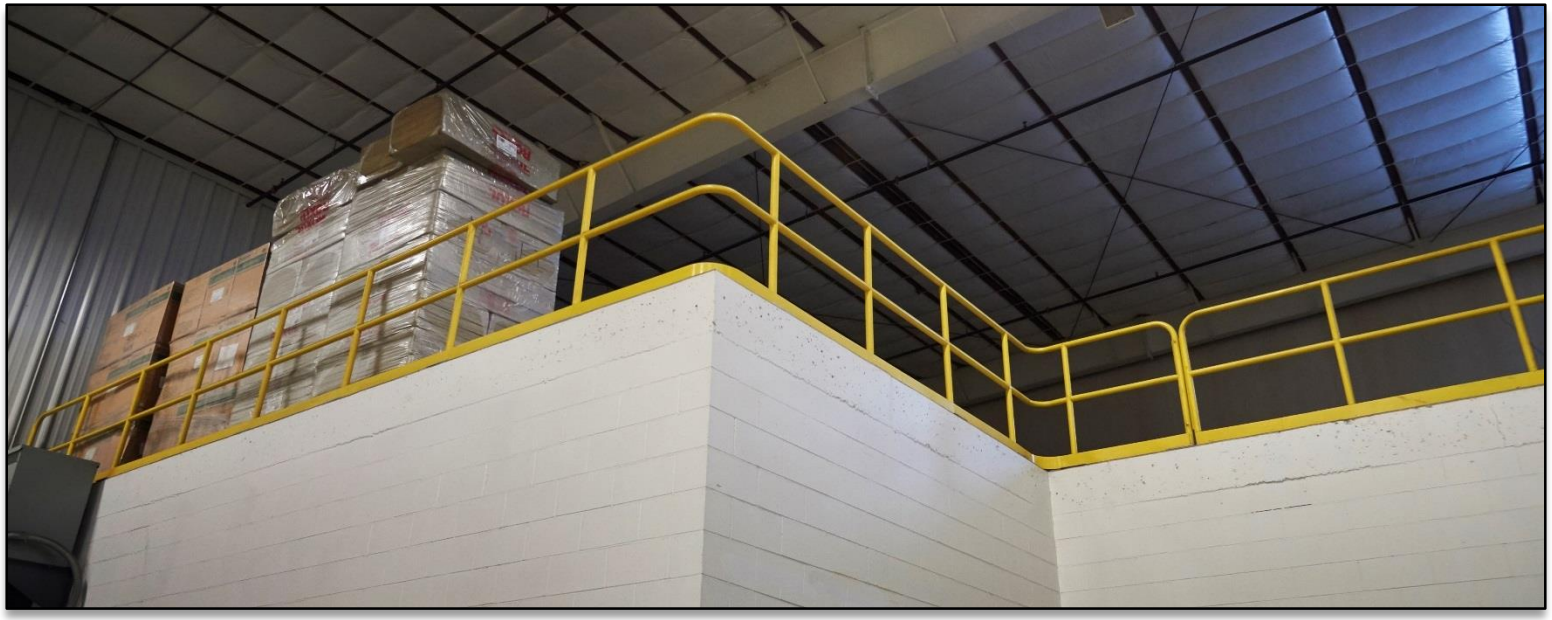
Fall Hazard Analysis

- Your employer is ultimately responsible for determining the appropriate fall protection method or system for your type of work operation.
- Employers now have more fall protection options under the final Walking-Working Surfaces rule.
- This allows them to choose a fall protection system that best meets the needs of your workplace.

Guardrail Systems

Guardrail Systems

A guardrail system is a physical barrier used along an unprotected or exposed side, edge, or other area of a walking-working surface to prevent workers from falling to a lower level.

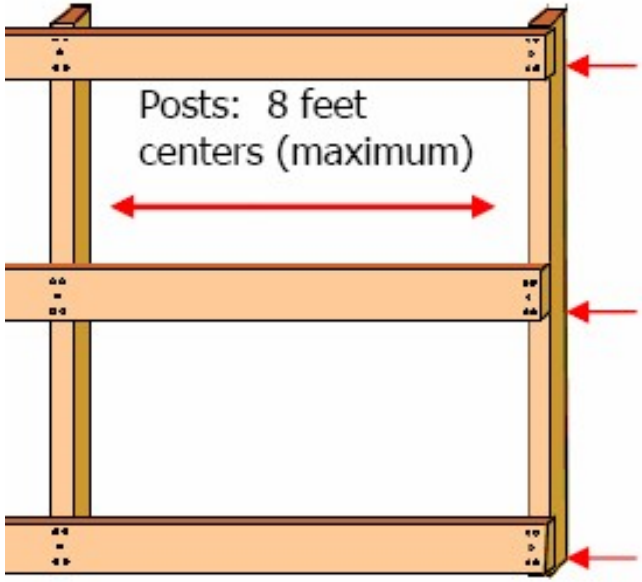


Guardrail Systems

Guardrails requirements:

- Guardrails are required to have a top rail and a mid-rail.
- Top rail must be able to withstand 200 pounds of outward or downward force in the event an average person would fall against the guardrail.
- Mid-rail must be midway between the top rail and the surface below be able to withstand 150 pounds of outward or downward force.

Guardrail System



Top Rail: Shall be 42 inches (plus or minus 3 inches) above walking/working level and support a 200 lb force.

Mid Rail: Shall be installed between the top rail and walking/working surface (generally, 21 inches) and support a 150 lb force.

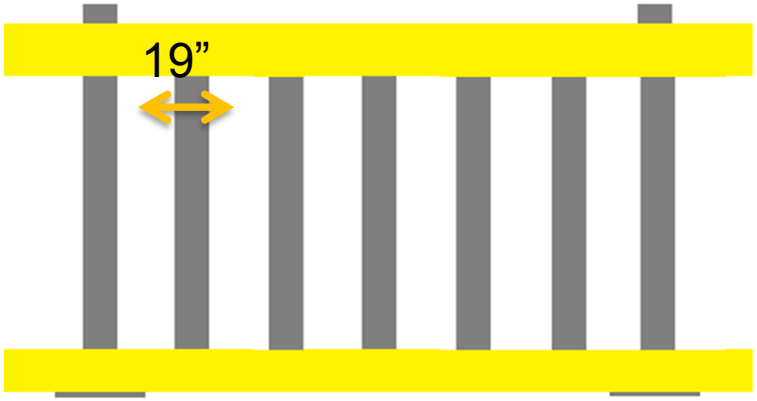
Toe Boards: Shall be 3 ½ inches high and support a 50 lb force.

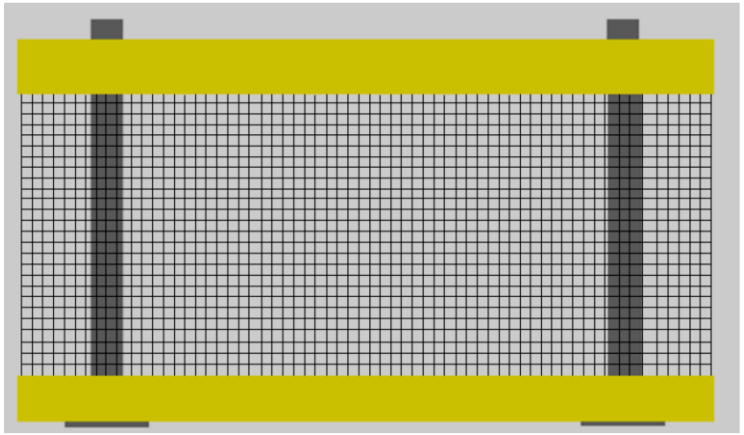
Guardrail Systems

- Constructed with smooth-surfaced materials to prevent punctures, laceration and snagging of clothing.
- The ends of top rails and midrails do not overhang the terminal posts.
- Posts are not further than 8 feet apart.
- Rails made be constructed of:
  - wood, 2” x 4”
  - steel pipe, diameter of 1.5”
  - Wire cable, not less than .25”
- Steel or plastic banding is not to be used for rails.

Fall Protection-Mid Rail

- Required if no wall or parapet at least 21" high
- Installed midway between top rail and working level
- May use screens, mesh or balusters instead of mid rail – must withstand 150 pounds, down & out
  - Screens & mesh run all along entire opening
  - Balusters (vertical rails, not more than 19 ” apart)





Fall Protection PPE

Video

Post Fall Protection System

Horizontal Lifeline System

Horizontal Lifeline System

Frame Horizontal Rail System

MOBILE TRAILERED FALL-ARREST

- 2 User Rated System (310 lb. / User)
- Free Standing Design can be detached from vehicle and used as free standing
- Portable Trailer can be moved within the yards and or mine sites.
- DOT Rated for Highway use
- Can be pulled by most vehicles without an issue.
- Can be backed up and positioned in tight spots of a yard.
- Meets/Exceeds OSHA Requirements

Mobile Fall Arrest System

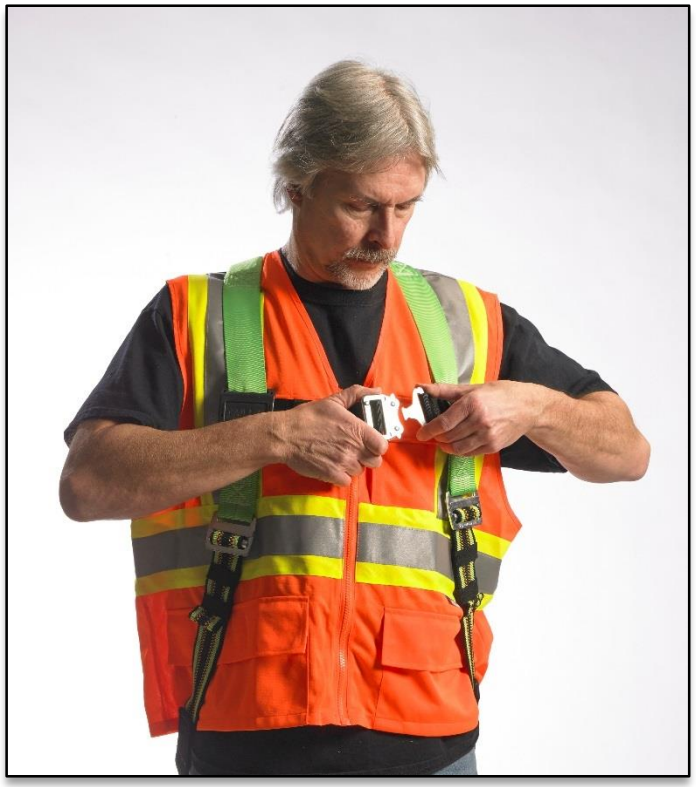
Fixed Ladder Safety System

Video


FALL PROTECTION BASICS
THE DIFFERENCES BETWEEN FALL PROTECTION, FALL PREVENTION,
FALL RESTRAINT AND FALL ARREST

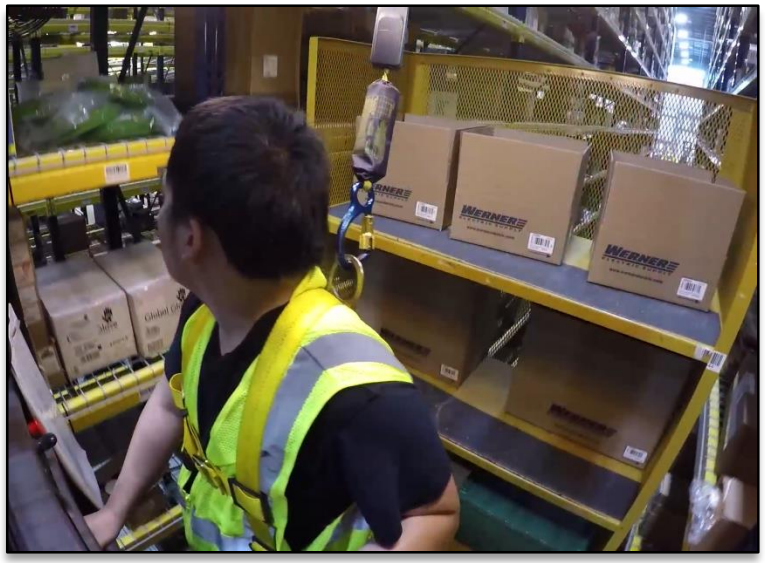
Personal Protective Equipment

If your employer was unable to eliminate or protect against fall hazards through modifications to the work environment, they are required to determine the most appropriate form of Personal Protective Equipment, or PPE, you'll need to use.



Personal Protective Equipment

PPE is your last line of defense and minimizes your exposure to a variety of hazards, including falls from elevated work levels or platforms.



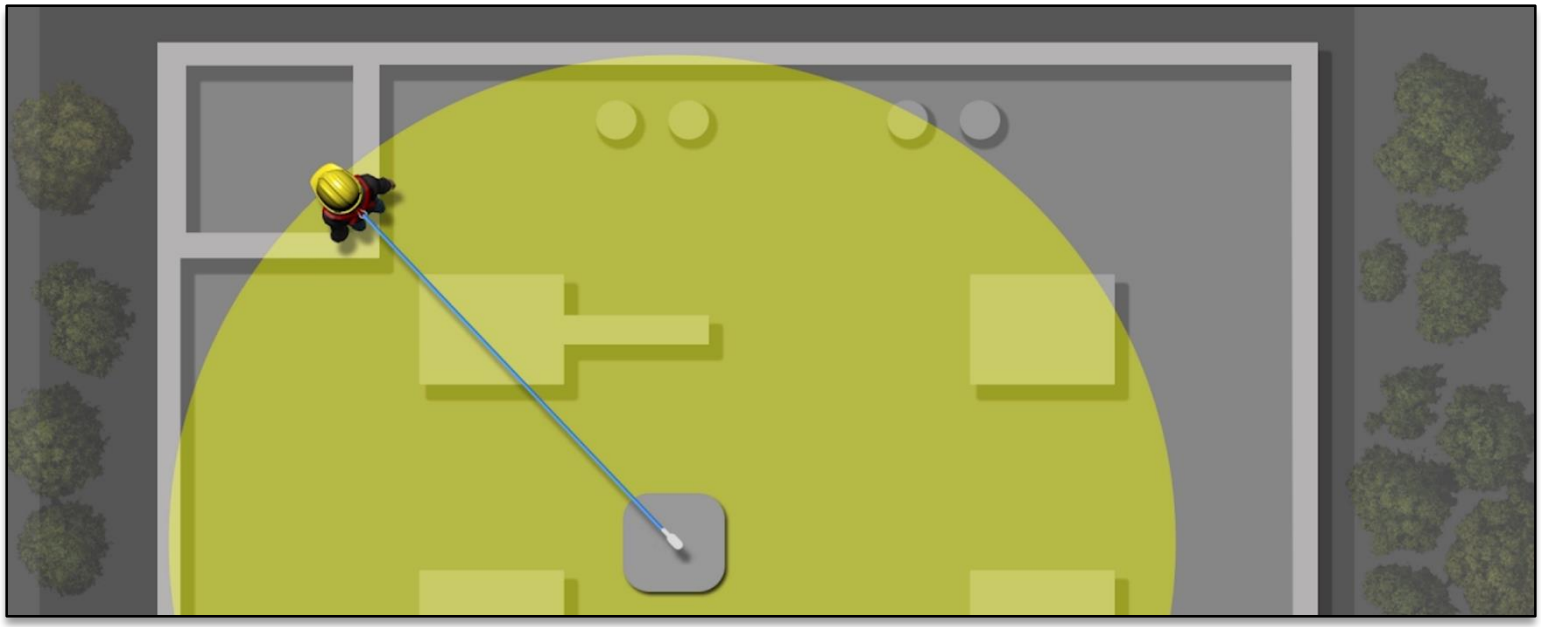
Three commons types of PPE are:

1. Personal Fall Arrest Systems
2. Travel Restraint Systems
3. Positioning Device

Personal Protective Equipment

Travel Restraint Systems

Eliminates the possibility of a worker going over the unprotected edge or side of a walking-working surface. Basically, this system lets you travel just far enough to reach the edge but not far enough to fall over.



Personal Protective Equipment

Travel Restraint Systems, (cont.)

A travel restraint system typically combines:

- Anchorage
- Body harness
- Connector
  - Anchorage connector
  - Lifeline
  - Lanyard

Personal Protective Equipment

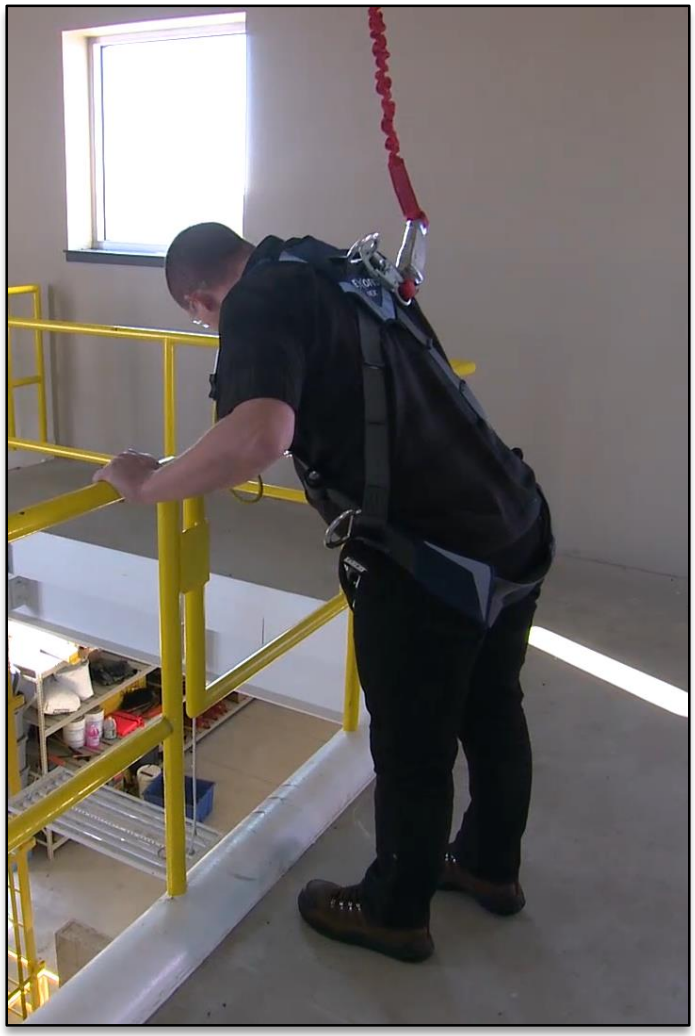
Personal Fall Arrest Systems

Used to stop an employee in a fall from an elevated work level.

These systems consist of a:

- Anchorage
- Body harness
- Connector
- Descent & Rescue

Connections may include a lanyard, deceleration device, lifeline, or a suitable combination.



Personal Protective Equipment

Personal Fall Arrest Systems, (cont.)

Personal fall arrest harnesses have a maximum weight capacity defined by the manufacturer, which includes the person and tools. If there is a need to use a personal fall arrest harness for someone outside the stated capacity, then your employer will need to contact the manufacturer and request a custom harness.

Body belts are not approved for a personal fall arrest system.

Personal Fall Arrest Systems

Personal Fall Arrest System (PFAS) includes

Harness

Anchor Point

Lanyard

Snaphook

D Ring

Carabineer

Personal Fall Arrest System

The A, B, C's

- **A**nchorage
- **B**ody Harness
- **C**onnectors

Anchorage

- "Anchorage" means a secure point of attachment for lifelines, lanyards or deceleration devices.

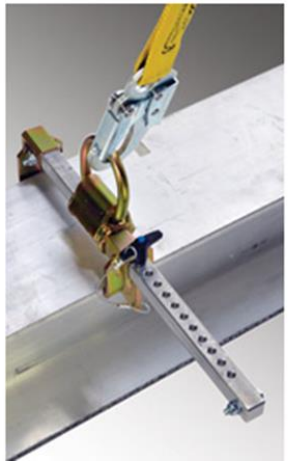
Fall Protection - Anchorage

- Shall be independent of any anchorage being used to support or suspend platforms.
- Never attach to a guardrail or a hoist unless designed to do so.
- Must be installed by a Qualified Person (Anchor Points or Horizontal Lifelines).
- Anchor points – 5000 lbs.

The PFAS does no good attached to itself

Certified Anchor Points

- Certified anchorages are those designed or approved by a **Qualified Person** considering peak dynamic loading with a safety factor of 2 times arresting force.



Qualified Person

- **Qualified Person**
  - One with a recognized degree or professional certificate, i.e. Engineer, PE, CSP, ASP
  - Possesses extensive knowledge *and* experience in the subject field, Fall Protection.
  - Capable of design, analysis, evaluation and specifications in Fall Protection work, project, or product.

Competent Person

- **Competent Person**
  - Designated by the employer
  - Responsible for
    - Immediate supervision
    - Implementation
    - Monitoring of the employer's Fall Protection
  - Trained & Knowledgeable in Fall Protection
  - Capable of identifying, evaluating, and addressing existing and potential fall hazards
  - Has authority to take prompt corrective action

Non-Certified Anchorages

- Non-certified anchor points may be utilized when it is not feasible to use a certified anchor point.
- A fall arrest anchorage that a ***competent person*** can ***judge*** to be capable of supporting the predetermined anchorage forces as prescribed in the standard.
- Non-certified anchorages consist of **unquestionably strong** elements of a structure, such as structural members.
- Non-certified anchor points must be able to support 5000 pounds static strength per employee attached.
- “Can I hang a car from it?”

Inadequate Anchor Points

- Standard Guardrails or Railings
- Ladders/Rungs
- Scaffolding
- Light fixtures
- Conduit or Plumbing
- Ductwork or Pipe Vents
- Wiring Harnesses
- Rebar
- Vents
- Fans
- Roof Stacks

Video – Good Anchor Point?

Body Harnesses

- A full-body harness designed to distribute fall-arrest forces over thighs, pelvis, waist, chest and shoulders; if a fall occurs, D-ring located in center of the back will hold worker in an upright position until rescued.

Connectors

- Used for attaching to D-rings on harnesses or horizontal lifelines
- Must be of the self closing and locking type.
- Do not attach more than one snaphook to a single D-ring.

Fall Protection - Lanyard

Tie Back Lanyard

Positioning Lanyard

Shock Absorbing Lanyard

Self Retracting Lanyard

Rip Stitch Lanyard

Single Lanyard

Personal Fall Arrest Systems

- Must restrict free fall to less than 6 feet.
- No contact with lower level.
- Provide prompt rescue.
- Inspect prior to each use.
- No body belts (for fall protection).

Video – ABCD's of PFAS

Using Fall Protection Safely

Choosing the Right Fall Protection

Although it's ultimately your employer's responsibility to select appropriate fall protection, you may be called upon to help.

As you discuss your fall protection options, be clear about the environment you'll be working in, the job you'll be conducting, the tools you'll be using, and how long the job will take. Also include any other factors you feel may be important to mention.

Choosing the Right Fall Protection

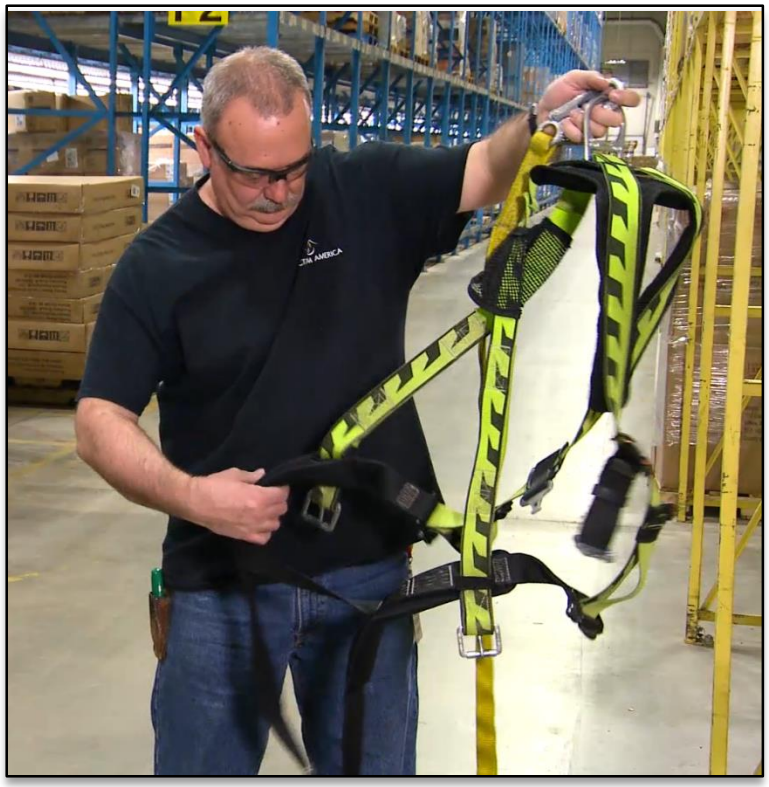
Remember, there are set requirements for fall protection in specific situations, including:

- Hoist areas
- Holes
- Runways
- Areas above dangerous equipment
- Openings
- Repair, servicing, and assembly pits
- Stairways
- Fixed Ladders
- Roofs
- Order picker forklifts
- Scaffolds

Video – Falls


TYPES OF FALLS
HOW TO CONTROL AND REDUCE THE RISK OF A FREE FALL

Inspecting Fall Protection



Inspections help you identify and correct problems before they cause any harm.

Fall protection equipment is to be inspected:

- Prior to being placed in service
- Annually and documented
- Prior to each use

Inspecting Fall Protection

Visually inspect your fall protection for any damage, deterioration, or broken parts. Pay particular attention to anything that can affect the integrity of the equipment, including:

- Mildew
- Wear
- Chemical or heat damage
- Brittle material
- Rust
- Mold
- Faulty connections
- Frays
- Cuts

Inspection

Before you climb – EVERY TIME:

- HARNESS – Cuts, tears, chemical stains, heat damage or burns, torn stitching, extreme fading, lack of labeling, excessive age
  - Check all D ring(s) and connecting hardware for damage, such as stretching, narrowing, bending, cracks, etc.
  - Make sure the fall indicator is not deployed

Inspection

Before you climb – EVERY TIME:

- LANYARD(s) – Same checks as for harnesses
  - Snap hook connectors show no damage and operate correctly and also need to be inspected for throat damage and damage to the keeper
  - Always follow the Manufacturer's Recommended Inspection Procedure
  - Snap hooks must be of self closing and locking type.

Record Inspection

8.0 INSPECTION AND MAINTENANCE LOG

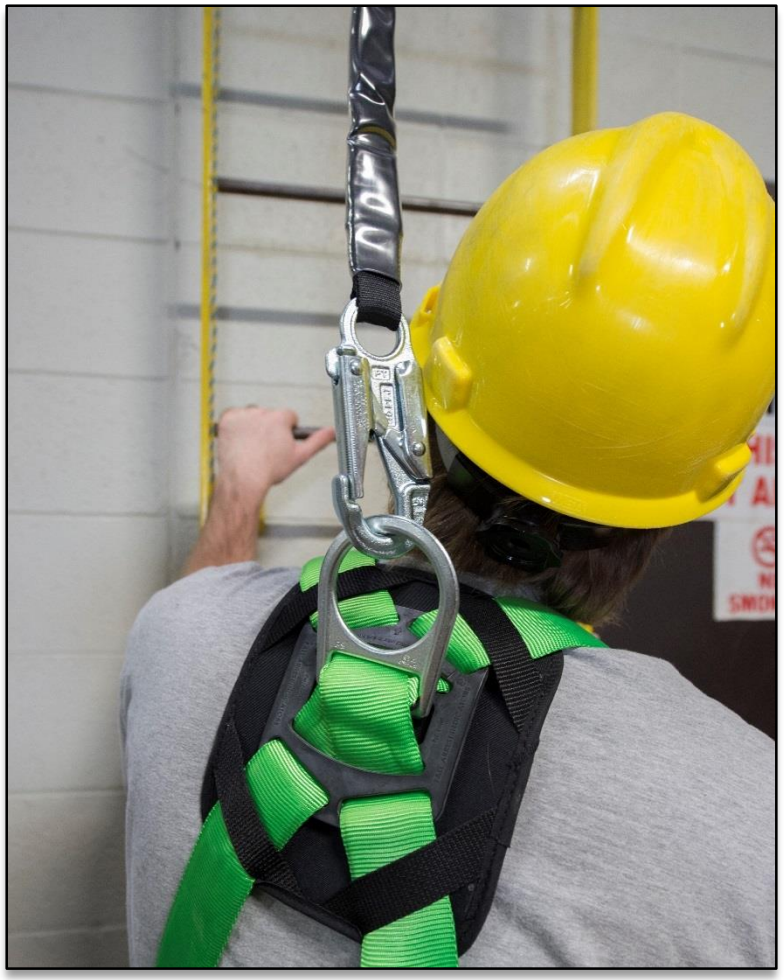
SERIAL NUMBER:	
MODEL NUMBER:	
DATE PURCHASED:	**DATE OF FIRST USE:**

INSPECTION DATE	INSPECTION ITEMS NOTED	CORRECTIVE ACTION	MAINTENANCE PERFORMED
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			
Approved By:			

Video – PFAS Inspections

Using Fall Protection

- Your fall protection is only as effective as you allow it to be.
- Be sure you correctly inspect set-up, operate, and maintain any fall protection systems and equipment you use.



Using Fall Protection

If you have any questions, or are unsure about anything, ask your supervisor, competent person, or safety professional.

Video – Fall Arrest Forces

Storing Fall Protection

- All your personal fall protection PPE should be stored in a designated storage area.
- The storage area should be a clean, cool, dry place, protected from chemicals and long-term direct sunlight.

Storing Fall Protection

- Your supervisor/safety professional will determine the most effective and safe means of personal fall protection PPE storage in your workplace, but it’s up to you to put it there when it’s not in use.
- If you see any fall protection equipment not in use and not stored properly, remove or report it.

Performing Maintenance

Basic care and maintenance can help keep your fall protection safety equipment in good working order.

Performing Maintenance

When damage or defects are discovered on any form of fall protection, report the damage, remove it from service or barricade the area immediately.

NCDOT policy is not to use it again until a competent person has determined it to be safe for use.

Performing Maintenance

- Impact loading is when fall protection equipment is in use and a fall occurs, stressing the fall protection equipment.

- If your personal fall protection PPE was subject to impact loading (or a fall,) a competent person must re-inspect it to determine if it can be used again.

Performing Maintenance

- Maintenance work on fall protection should always be performed per manufactures recommendations and must be done or supervised by a qualified person.
- If you see any damage or defects in fall protection equipment, or something doesn’t seem right, report it immediately.
- Damaged personal fall protection PPE that is beyond repair will need to be destroyed.

Emergency Procedures

- Prior to working at heights that require fall protection, a rescue plan must be established.
- Fallen workers must be contacted within 4-6 minutes.
- This includes the provision for rendering first aid.
- Rescue plan should be briefed prior to working at height.
- If local EMS providers are part of the rescue plan, have they been contacted to determine:
  - Ability for a timely response, location, vehicle, volunteer department versus paid
  - High angle rescue training and equipment
- Meet with local EMS to discuss and collaborate a rescue plan.

Rescue Plan

A rescue plan must be in place with the ability to implement the plan in the event of a fall.

- Self Rescue
  - 90 % of workers will be able to perform
- Assisted self-rescue
  - May be mechanically aided
- Assisted rescue
  - Injured or unconscious

Self-rescue

- Victim climbs back to the level from which he fell
- Returns to floor or ground for medical evaluation
- All components of fall arrest system removed from service and tagged out of service until evaluated by a competent person due to impact loading

Assisted Self-rescue

- Local fire department may be High Angle Rescue trained and equipped
- Call and verify prior to working at height
- Victim is conscious and able to assist in aid
- This may be performed by NCDOT personnel if trained in rescue techniques
- Anchor point for rescue rope must be rated at least 3,000 lbs.
- Haul line may be swung over or lowered to the fallen worker

Assisted Self-rescue

- Victim grasps rescue line with snap hook and attaches to body harness D-ring
- A positive D-ring connection must be verified by rescue team member
- The rescue team raises or lowers fallen employee
- Employee is to be medically evaluated
- Fall arrest equipment is removed from service and tagged for impact loading inspection

Assisted Rescue

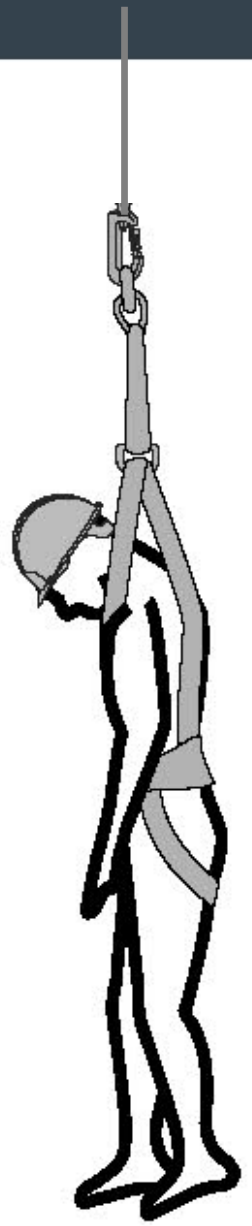
- Fallen employee is unconscious or unable to attach rescue system (haul line) to D-ring
- A rescue team member must attach haul line to victim
- Rescue team raises or lowers victim to safe level

Charlotte Rescue

Suspension Trauma

After a fall, if a person is stranded in their harness the weight of their body on the leg straps cuts off blood flow returning to the torso. Blood pools in the legs severely limiting flow to their upper body and head.

- Unconsciousness overcomes the victim followed shortly after by respiratory arrest in as little as 10 -15 minutes after suspension begins
- Once the victim is lowered to the ground and tension is released, a large volume of poorly oxygenated blood will flow back to the heart, lungs and brain from the legs.
- This complicates their rescue, compromises resuscitation efforts and ultimately threatens their survival...
    - Detailed FIRST AID TRAINING should be provided to anyone who may have to treat a victim of Suspension Trauma

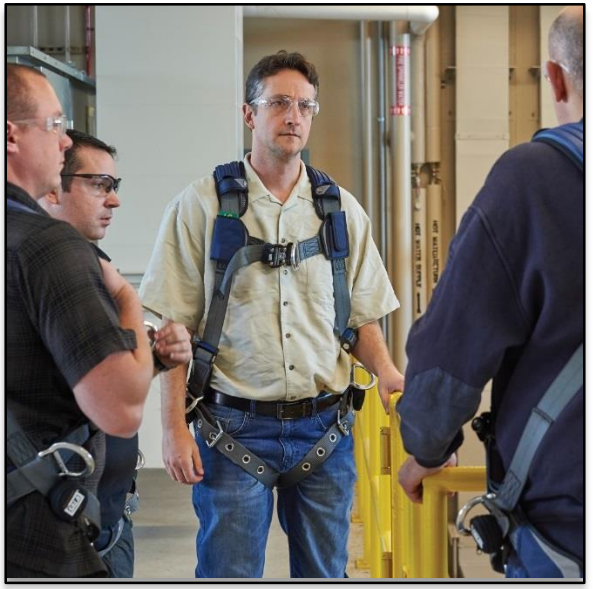


Video – Suspension Straps

Training

You also must be re-trained when:

- Changes in your workplace make your previous training invalid.
- Changes in the types of fall protection systems or equipment you use make your previous training invalid.
- You demonstrate a lack of understanding or skill necessary to use the equipment or perform your job safely (like if you are wearing personal fall protection incorrectly).



Objectives Review

You should now be able to:

- Explain how injuries by falling occur.
- Describe ways to eliminate and prevent fall hazards in the workplace.
- Summarize employer requirements to protect workers from fall hazards.
- Identify various forms of fall protection and scenarios when each would be appropriate.

FAQ

- Q: Can you connect a snaphook into the eye of another hook?
- A: No. Both OSHA and ANSI standards indicate that snaphooks and carabiners should not be connected to each other. The hook also needs to align with the applied load if connected to the eye of another hook, the hook may not be able to move or rotate when a load is applied. Compatibility between the two connections may also be a concern.

FAQ

- Q: Should you wear a Full Body Harnesses over or under winter clothing?
- A: A harness should be worn over winter clothing. It is more visible for inspections and there is less chance for clothing to interfere with buckles and snaphooks. Additionally, when the harness is on the outside, if there is a fall and the harness is pulled upward, there is less possibility that the person could be choked.

FAQ

- Q: What is a "timely manner" for rescue according to ANSI and OSHA?
- A: The ANSI Z359.2-2007 code recommends less than six minutes to make contact with the subject. As a part of the fall protection program, both internal and external rescue services should be evaluated to determine which options are most desirable. OSHA, on the other hand, requires the provision of medical aid within four to six minutes.

Video – Personal Fall Arrest Sys.

Conclusion

- Because falls are among the most common causes of serious work-related injuries and deaths, it’s important to comply with the regulations.
- By identifying potential hazards and using the fall protection in the right way, you can help prevent falls from even occurring in the first place.